EFFECT OF COW COLOSTRUM ON ARTIFICIALLY REARED PIGLETS

by

MARK THOMAS NOLL

B.S., Kansas State University, 1978

A MASTER'S THESIS

submitted in partial fulfillment of the

requirements for the degree

MASTER OF SCIENCE

Department of Animal Sciences and Industry

KANSAS STATE UNIVERSITY

Manhattan, Kansas

1979

Approved by:

Gary L. Allee

Major Professor

ACKNOWLEDGMENTS

The author wishes to express his sincere appreciation to his graduate committee, Drs. Duane Davis, Robert Hines, David Schoneweis, and especially his major professor, Dr. Gary Allee, for their guidance and support.

The author also wishes to thank the staff of the swine research unit and especially fellow graduate students Jack Salava and Andy Thulin for their cooperation and assistance throughout these experimental studies.

In addition, the author wishes to extend his appreciation to his parents, Tom and Mayme Noll, for their support throughout his education.

A special thanks is given to the author's fiancee, Joanne, whose assistance, patience and understanding were of immeasurable value.

Finally, the author wishes to acknowledge his faith in God and the tremendous impact that faith has had.

TABLE OF CONTENTS

LIST OF TABLES

INTRODUCTION

Many people would question the wisdom of artificially rearing baby pigs since the sow can obviously do it easier and more economically. But to those who have ever looked at a sow with 16 pigs and 10 teats or a sow unable to milk, the answer is easy. There are times when the sow is unable to handle her pigs and if there are no sows with small litters available to adopt the pigs, starvation is inevitable. Attempts to rear these extra pigs artificially have a high potential for frustration. Removed from the sow's milk and the protection provided by her colostrum, these orphaned pigs often succumb to disease. Attempts to supply immunity in artificial rearing with serum derived immunoglobulins have been successful, but not very practical. Bovine colostrum has also been successfully used to provide immune protection, but unlike serum derived immunoglobulins, colostrum is relatively inexpensive and in most areas readily available.

The purpose of this study was to examine the potential of cow colostrum for artificially rearing of pigs and to develop a feeding system that was inexpensive and practical.

REVIEW OF LITERATURE

Data from several researchers (Pomeroy, 1960a; Kerncamp, 1965; Fahmy and Bernard, 1971; Rodeffer et al., 1975) indicate that mortality from birth to weaning of pigs born alive is from 20 to 25 percent. This figure varies with litter size, ranging from 20 percent for litters of 10 and less to 47 percent mortality for litters from 10 to 15. Mortality rates also increased in small litters. Pomeroy (1960b) reported in 57 litters of three pigs or less, all the pigs died in 25 cases. The primary reason was lactation failure due to a lack of stimulation. The increase in mortality for the large litters is due largely to two reasons. First, the piglets are limited by the number of functional nipples available. Second, these large litters usually have smaller pigs. This, combined with a shortage of teats, results in a struggle for the survival of the fittest. The losers usually are the smallest pigs. These relatively smaller pigs are handicapped not only by smaller muscles with which to compete, but also by a relatively larger body surface area, resulting in a greater relative heat loss (Pomeroy, 1960c).

English and Smith (1975) showed that 42.8 percent of the piglets lost were clinically normal piglets at birth, but had lighter birth weights. Although the pigs lost were smaller, these authors felt that if provided an adequate environment and nutrition, these smaller piglets would survive. Some causes given for the preweaning mortality were crushing, disease and starvation, with starvation being the largest single predisposing factor to mortality (Sharpe, 1966; English and Smith, 1975). Crushing and disease are often the secondary effects which remove the pigs weakened by starvation.

Work on pre-weaning mortality points to a need for an alternate means of rearing extra and/or orphaned baby pigs. To this end, much time and money have been spent. One major stumbling block to successful artificial rearing is the lack of immune protection at birth due to the impermeability of the placenta to immunoglobulins (Stergel et al., 1966; Bengtsson, 1974). The newborn pig receives passive immune protection from the sow's colostrum and milk (Hoerlein, 1957; Lecce, et al., 1962; Rejnek et al., 1968; Wilson, 1974). This protection can be divided into two main areas; systemic and local. To provide systemic protection, the small intestine is "open." That is, immunoglobulins are transported across the entire small intestinal epithelium via pinocytosis into the blood. These absorbed immunoglobulins then provide protection against systemic infection. Their half life is about 22 days (Martinsson, 1970) and are usually exhausted from the system by 40 days (Harmon et al., 1973). Murato and Namioka (1977) have shown that pinocytosis in the epithelium disappeared two hours after birth in the duodenum, 48 hours in the jejunum and 72 hours in the ileum. Lecce (1973) found that cessation of absorbtion could be altered by diet and frequency of feeding. Most researchers agree that the major absorbtion of immunoglobulins ceases at about three days (Lecce and Matrone, 1960; Tloskalova et al., 1970; Patt and Eberhart, 1976; Murato and Namioka, 1977). An interesting point on these circulating immunoglobulins is their inhibition of antibody production in the piglet (Hoerlein, 1957; Harmon et al., 1973; Wilson, 1974). Their work suggests that absorbed immunoglobulins repressed synthesis of antibodies until catabolic processes lowered the level of antibodies to permit initiation of synthesis.

Another area of protection offered by colostrum and milk is local protection from enteric diseases. Circulating antibodies have little effect on immunity to enteric diseases (Kohler, 1967; Lecce, Coalson, Mock, 1972) since they are apparently unable to reach the intestinal mucosa in sufficient quantities to prevent infection. Immunoglobulins provided daily allow the intestinal mucosa to be continually protected. Colostrum and milk are especially effective for providing continuous protection. This is due to the presence of a secreting antibody (IgA) specifically suited for local defense because of its resistance to proteolytic degradation and its persistence on the intestinal lumen surface where it is able to inactivate the disease (Rejnek et al., 1968; McCallum et al., 1976). Martinsson (1970) showed that immunoglobulins given orally without colostrum were absorbed in very small amounts, and suggested that a trypsin inhibitor protected the immunoglobulins from digestion.

With artificial rearing, the piglet may have very little or no exposure to colostrum, thus having a very low circulating immunoglobulin level. The daily local protection is also unavailable, thereby leaving the piglet doubly unprotected. This lack of protection can result in mortalities up to 100 percent (Owen et al., 1961; Scoot et al., 1972). To alleviate this problem, many researchers have experimented with supplementing immunoglobulins in the diet. These immunoglobulins have been derived primarily from swine and bovine serum. Owen et al. (1961), Scoot et al. (1972), and McCallum et al. (1976), working with newborn colostrum-deprived pigs, found that orally administered porcine immunoglobulins significantly lowered mortality and susceptibility to infection. Bovine colostrum as a source of immunoglobulins was also found to be effective (Pierce and Smith, 1967; Lecce, 1969; McCallum et al., 1976; Lecce, 1975; Lecce and King, 1978). Bovine colostrum seemed to offer the most practical source of immunoglobulins. Colostrum only requires freezing, whereas serum must undergo extensive processing before use, resulting in a fairly expensive product.

Coalson and Lecce (1973) have shown that immunoglobulins in the sow's mammary secretions drop rapidly with each ejection of the gland. Therefore, some workers have concluded that piglets should be farrowed in a manner that would allow all equal access to the first colostrum. No differences in blood serum levels or piglets performance were seen between pigs farrowed naturally and pigs that were removed and returned simultaneously (Hendrix et al., in press). Returning the pigs together would seem to have its maximum effect if the sow farrowed over an extended period of time or if piglets were removed after a short period of nursing. If pigs are removed early, one must determine what length of suckle is adequate. Time required to receive adequate protection varies with disease and sanitation levels. Coalson and Lecce (1973b) found that 12 hours equaled 36 hours of nursing in a sanitary environment, whereas in a less desirable environment, 36 hours offered more protection even though the 12 and 36 hour pigs had equal circulating immunoglobulins (Lecce et al., 1972). Earlier work (Lecce and Matrone, 1961) showed that pigs weaned at four days had developed sufficiently to have serum protein profiles continue uninterrupted. In colostrum deprived pigs, Owen et al. (1961) found globulins fed for five days reduced the susceptibility to infection. Most workers have found that feeding gamma-globulins at 2 g. per kilogram body weight for 10 days gives the maximum protection (Scoot et al., 1972; McCallum et al., 1976).

At weaning, pigs can be placed in individual or group pens. Individual pens eliminate competition between pigs and problems of ear sucking reported by some workers (Pettigrew and Harmon, 1975). Feeding intervals for weaned pigs are not commonly agreed upon. When on the sow, pigs will nurse about every 60-90 minutes (Barber et al., 1955; Hartman et al., 1962). Several automatic feeding devices are available that feed pigs at these intervals. However, Braude et al., (1970) compared feeding at hourly intervals with twice-daily feedings and found no significant effect on live-weight gain but an improvement in feed conversion was observed with hourly feeding.

The objectives of the present studies were to take an indepth look at bovine colostrum supplementation in the artificial rearing of baby pigs and to determine a practical application for bovine colostrum supplementation. In selecting our methods and materials, we kept foremost in our minds the practical, economical and time limitations of the swine producer.

EXPERIMENTAL PROCEDURE

Animals

All pigs used in these trials were from the Kansas State University swine herd. In experiments 2 and 3, purebred Yorkshires were used and in experiments 1 and 4, Yorkshire x Hampshire x Duroc pigs were used. In experiments 2 and 3, the pigs were removed immediately at birth and returned simultaneously after the last pig was born. Newborn pigs were weighed and given the desired day 1 care. All pigs nursed the sow for at least 15 hours and not more than 24 hours. Pigs were allotted to treatment by litter and weight. Deformed or injured pigs were not used.

Housing

Upon removal from the sow, pigs were taken to a room measuring 6.09 x 9.14m, located on the university swine farm. Pigs were reared in individual 30.48 x 60.96 x 30.48cm cages made of 2.54 x 5.08cm welded wire with .94cm wire netting on the floor. Cages were equipped with 200ml capacity plastic cups. Room temperature was maintained at 32° Celsius. At weaning, pigs were taken to a conventional nursery with group pens.

Feeding

A commercial milk replacer (Soweena^{R}) manufactured by Foremost Company was used. The stated composition of this milk replacer is given in Table 1. In experiments 1 and 2, the milk replacer was fed at the recommended 15% dry matter. This was increased to 25 and 30% for experiments 3 and 4, respectively. Pigs received no water or milk for the first six hours after removal from the sow. After that, they were fed every six hours the first day. Each pig was introduced to the milk by having their nose placed in it. Usually two or three pigs would not eat the first feeding, but in all experiments all pigs consumed the second feeding. The second day, pigs were fed every 8 hours and day 3 through 21 were fed every 12 hours. Daily volume was divided equally among the feedings. The first day, pigs received their treatments of colostrum plus milk replacer to a volume of 400 milliliters. After the period of colostrum feeding, pigs were continued on a milk replacer diet. Volume increased with appetite, reaching a maximum of 1200 ml during days 4-21. At 2 weeks of age, a dry pig starter (Table 1) was mixed with the milk replacer at the rate of 120 gms per head per day until moved to the conventional nursery at 3 weeks of age. Water in addition to that in the milk replacer was only given in trial 4. The cow colostrum used was from first and second milkings from the Kansas State University Dairy Center. Colostrum (Table 1) was frozen in ice cube trays (25ml) and gallon milk cartons, and then thawed in quantities needed each day.

The serum derived immunoglobulins were prepared from blood collected at slaughter from the university swine. The blood was allowed to clot and the serum removed. The serum was then centrifuged and freeze dried.

GENERAL PROCEDURES

Diarrhea scores were taken daily and scored from 0 to 3 with scores 0, 1, 2 and 3 indicating normal feces, loose feces, moderate diarrhea and extremely watery diarrhea, respectively. Pigs were weighed weekly midway between daily feedings to avoid the influence of fluctuating stomach contents.

Experiment 1

Sixteen pigs from two litters were allotted to four treatments: 1) milk replacer only; 2) 400 ml of cow colostrum day 1; 3) 400 ml cow colostrum day 1 followed by 125 ml cow colostrum day 2-10; 4) 400 ml cow colostrum day 1 followed by 2 grams immunoglobulins provided by freeze dried swine serum until day 10. Gentacin was given to all pigs day 1 and for treatment of diarrhea when necessary.

Experiment 2

Twenty-four pigs from two litters were allotted to six treatments: 1) milk replacer only; 2) milk replacer only plus antibiotics given when diarrhea was observed; 3) 400 ml cow colostrum day 1 followed by 125 ml cow colostrum day 2-10; 4) 400 ml cow colostrum day 1 followed by 125 ml cow colostrum day 2-21; 5) 125 ml cow colostrum day 1-10; 6) 125 ml cow colostrum day 1-21. All pigs received Gentacin when removed from the sow. Only treatment 2 received any further antibiotics during the course of the trial.

Experiment 3

Thirty-six pigs from four litters were allotted to six treatments: 1) milk replacer only; 2) milk replacer plus antibiotic on day 3; 3) 125 ml cow colostrum days 1 through 3 plus antibiotic day 21; 4) 125 ml cow colostrum days 1 through 3 and days 18-21; 5) 125 ml cow colostrum days 1-21; 6) 125 ml cow colostrum days 1-21 plus antibiotic day 3. Pigs did not receive additional antibiotics.

Experiment 4

Sixty-four pigs from eight litters were allotted to eight treatments: 1) milk replacer only; 2) 120 ml cow colostrum days 1-21; 3) 60 ml cow colostrum days 1-21; 4) 30 ml cow colostrum days 1-21; 5) 120 ml cow colostrum days 1-10; 6) 60 ml cow colostrum days 1-10; 7) 30 ml cow colostrum days 1-10; 8) 120 ml cow colostrum as needed for treatment of diarrhea. Pigs did not receive additional antibiotics.

RESULTS

Experiment 1

Results of experiment 1 are shown in Table 2. Supplementation of the milk replacer diet with cow colostrum resulted in a significantly higher average daily gain the first week. On the second week of the experiment this same trend was observed only with smaller relative differences. The cumulative diarrhea score was improved by the 10 day colostrum treatment with no differences between milk replacer only and cow colostrum on day 1 only. The freeze dried porcine serum treatment was marked by severe diarrhea the first week, resulting in the death of 3 out of 4 pigs. The processing method used in preparing the freeze dried serum resulted in an unpalatable product with a 3.1% sodium concentration. Average daily gain week 3 and average weight, weeks 3 and 6, were similar for all treatments.

Experiment 2

Results of experiment 2 are shown in Table 3. Supplementation with cow colostrum improved average daily gain during weeks 1 and 2 and gave the lowest diarrhea score. Antibiotics in addition to the milk replacer had no significant effect over milk replacer alone on pig performance, incidence or severity of diarrhea. Increasing the quantity of colostrum on day 1 from 120 to 400 ml was effective only on the 10 day treatment. Pig performance was similar between pigs fed cow colostrum for 10 or 21 days. Average weights of pigs at 3 and 6 weeks were similar for all treatments, except for those on the milk replacer alone and pigs fed 125 ml cow colostrum for 10 days which were slightly smaller.

Experiment 3

Results of experiment 3 are shown in Table 4. Supplementation with cow colostrum increased average daily gain week 1. In weeks 2 and 3, gains were similar except for pigs given the antibiotic treatment and 125 ml cow colostrum days 1 through 3 plus antibiotic day 21 treatment (treatment 3). Average weights at 3 weeks for pigs fed colostrum diets except treatment 3 were superior to milk replacer alone or milk replacer plus antibiotic diet. The final weights at 6 weeks were greatest for 125 ml cow colostrum days 1-21 plus antibiotic day 3, followed by colostrum treatments 4 and 5 with the milk replacer pigs being slightly less. The antibiotic and cow colostrum treatment 3 were the smallest at 6 weeks but were not significantly different.

Experiment 4

Results of experiment 4 are shown in Table 5. Supplementation of the milk replacer with cow colostrum resulted in no significant differences in average daily gain, diarrhea scores or final average weight. Quantity of cow colostrum fed (30, 60, or 120 ml per head per day) did not effect pig performance. Similarly, duration of cow colostrum feeding (10 vs. 21 days) did not effect pig performance. Diarrhea scores were similar for all treatments.

TABLE 1. COMPOSITION OF LOW COLOSTRUM, MILK REPLACER AND STARTER DIET

Milk Replacer[a]		Starter (%)		Cow Colostrum	
Crude Protein	25%	Ground Corn	53.85	Crude Protein	17.5%
Crude Fat	10%	Soybean Meal	27.00	Dry Matter	25.0%
Lactose	50%	Dried Whey	15.00	Cal./gm	5790
Cal./gm	5502	Dicalcium Phosphate	1.80		
Neomycin Sulfate	381 grams/ton	Limestone	1.00		
		Salt	.30		
		Vitamin Mix[b]	.50		
		Trace-mineral[c]	.10		
		ASP-250	.25		
		L-Lysine HCl	.20		
			100.00		

[a]Soweena brand milk replacer by Foremost.

[b]Each kilogram of mix contained the following: Vitamin A palmitate, 880,000 IU; Vitamin D_3, 66,000 IU; Vitamin E, 4,400 IU; Riboflavin, 990 mg; d-pantothenic acid, 2,640 mg; Niacin, 5,500 mg; Choline chloride, 101,420 mg; Vitamin B_{12}, 4.84 mg; Menadione sodium bisulfite, 699.6 mg.

[c]Contained 0.1% Cobalt, 1.0% Copper, 0.3% Iodine, 10% Iron, 10% Manganese and 10% Zinc.

TABLE 2. EFFECT OF COW COLOSTRUM AND PORCINE SERUM DERIVED IMMUNOGLOBULINS ON PIG PERFORMANCE (Experiment 1)[a]

	Weeks	Milk Replacer	Cow Colostrum Day 1	Cow Colostrum Days 1-10	Cow Colostrum Day 1 Pork Serum Days 2-10
Ave. Daily Gain (gm)	I	58.4^{d}	81.1^{c}	82.7^{c}	29.2^{e}
	II	98.1^{e}	107.8^{de}	128.9^{d}	175.1^{c}
	III	201.1	203.5	163.0	181.6
Ave. Weights (kg)	III	3.94	4.18	4.07	4.13
	VI	8.15	7.41	7.47	7.16
Diarrhea Score[b]		8^{d}	8^{d}	1^{c}	24^{e}
Mortality		0	0	0	3

[a]Four pigs per treatment.

[b]Cumulative diarrhea scores based on a score of 0 to 3, with 0 being normal and 3 being severe diarrhea.

[cde]Means in the same line with different superscripts are significantly different ($P<.05$).

TABLE 3. EFFECT OF COW COLOSTRUM ON PIG PERFORMANCE, DIARRHEA SCORE AND MORTALITY (Experiment 2)[a]

	Weeks	Milk Replacer	Antibiotic	400-125 ml per 10 days	400-125 ml per 21 days	125 ml per 10 days	125 ml per 21 days
Ave. Daily Gain (gm)	I	64.9^{d}	71.3^{d}	116.7^{c}	97.3^{c}	100.5^{c}	102.2^{c}
	II	133.0^{e}	134.6^{e}	157.3^{cb}	158.9^{cb}	147.6^{de}	165.4^{c}
	III	223.8	243.2	243.2	240.0	202.8	222.2
Ave. Weights (kg)	III	4.23	4.40	4.88	4.74	4.43	4.70
	VI	7.20	8.24	8.33	8.49	7.41	8.43
Diarrhea Score[b]		16^{d}	18^{d}	3^{c}	2^{c}	1^{c}	1^{c}
Mortality		0	0	0	0	0	0

[a]Four pigs per treatment.

[b]Cumulative diarrhea scores based on a score of 0 to 3, with 0 being normal and 3 being severe diarrhea.

[cde]Means in the same line with different superscripts are significantly different ($P<.05$).

TABLE 4. EFFECT OF COW COLOSTRUM ON PIG PERFORMANCE, DIARRHEA SCORE AND MORTALITY (Experiment 3)[a]

	Weeks	Milk Replacer	Antibiotic Day 3	125 ml Day 1-3 plus Antibiotic Day 21	125 ml Day 1-3 and Day 18-21	125 ml Day 1-21	125 ml Day 1-21 plus Antibiotic Day 3
Ave. Daily Gain (gm)	I	63.6^{f}	82.4^{ef}	100.5^{de}	125.2^{cd}	144.0^{c}	139.4^{c}
	II	177.1^{c}	154.4^{cd}	136.3^{d}	182.9^{c}	175.1^{c}	177.1^{c}
	III	248.4^{d}	220.5^{e}	225.7^{e}	275.6^{c}	282.1^{c}	269.2^{cd}
Ave. Weight (kg)	III	4.90^{d}	4.67^{d}	4.59^{d}	5.43^{c}	5.53^{c}	5.44^{c}
	VI	9.59	8.78	8.49	9.69	9.31	10.10
Diarrhea Score[b]		39^{e}	18^{d}	17^{d}	6^{c}	1^{c}	5^{c}
Mortality		2	1	0	0	0	0

[a]Six pigs per treatment.

[b]Cumulative diarrhea scores based on a score of 0 to 3, with 0 being normal and 3 being severe diarrhea.

[cdef]Means in the same line with different superscripts are significantly different (P<.05).

TABLE 5. EFFECT OF COW COLOSTRUM ON PIG PERFORMANCE, DIARRHEA SCORE AND MORTALITY (Experiment 4)[a]

			Cow Colostrum						
			21 Day			10 Day			
	Weeks	Milk Replacer	120 ml	60 ml	30 ml	120 ml	60 ml	30 ml	120 ml as Treatment
Ave. Daily Gain (gm)	I	139.4	142.0	140.1	129.7	140.1	145.3	153.1	136.8
	II	158.3^{cd}	186.1^{c}	177.1^{c}	185.5^{c}	175.1^{c}	140.1^{d}	190.7^{c}	173.8^{c}
	III	182.4	208.5	188.9	192.0	200.2	189.0	193.8	187.3
Ave. Weight (kg)	III	4.64	5.05	4.90	4.95	4.95	4.74	5.11	4.82
	VI	8.64	8.71	8.27	9.19	8.74	8.64	8.80	9.21
Diarrhea Score[b]		20	39	38	49	49	52	31	51
Mortality		0	1	0	0	0	1	0	0

[a]Eight pigs per treatment.

[b]Cumulative diarrhea scores based on a score of 0 to 3, with 0 being normal and 3 being severe diarrhea.

[cd]Means in the same line with different superscripts are significantly different ($P<.05$).

DISCUSSION

The results of these studies indicate the ability of cow colostrum to reduce the incidence of diarrhea thereby increasing gains the first week of life and reducing mortality. Cow colostrum as a source of immunoglobulins has been shown to be effective by other workers (Lecce, 1969; Lecce, Coalson and Mock, 1972; Lecce, 1975; McCallum, Elliot and Owen, 1976). Their results demonstrated with cow colostrum supplementation, increased weight gains and reduced mortality relative to the control group. In our experiments, the main benefits from supplemental cow colostrum were during the first week. In experiments 1 through 3, supplementation with cow colostrum decreased the incidence of diarrhea and increased average daily gains during the first week. The milk replacer only pigs gain improved in the second week, and usually were similar to colostrum fed pigs in the third week. At 3 weeks the average weights for colostrum pigs were slightly greater than milk replacer only pigs. The final weights at 6 weeks were similar for all treatments. This suggests that during the stressful period following removal from individual cages to a conventional nursery and changing from a liquid to a dry diet, pigs fed only milk replacer outperformed pigs that had received cow colostrum. Pig gains in this period for the 96 colostrum fed pigs were 3.78 kg compared to 4.48 kg for the milk replacer only pigs. Several researchers (Hoerlein, 1957; Harmon, Jenson and Baker, 1973; Wilson, 1974) reported that antibody formation is depressed in pigs receiving colostrum. Possibly, in our studies, the pigs receiving colostrum did not have as mature an immune system as the non-supplemented pigs, thereby explaining the non-supplemented pigs superior performance. Another possibility is that the difference was due to a combination of the controls being more accustomed to stress after a period of diarrhea, and some compensating gain from their early stressful period. In experiment 4, the occurrence of diarrhea was due to a negative water balance from feeding the milk replacer at 30% solids with no additional water. There were no pathogenic organisms found to be responsible. This could explain why there was no first week advantage with colostrum supplementation. The additional immune protection was not needed.

The twice a day feeding schedule used in these experiments gave similar gains to the more frequent feeding schedules of other researchers (Danielson, 1971b; Pettigrew and Harmon, 1975; Haye and Kornegay, 1979; and Lecce et al., 1979). Advantages of the twice a day feeding program are saving the expense of an automatic feeding device without investing a great deal of time in the pigs. Between feedings the pigs would act hungry and squealed when anyone entered their room. But at three weeks, when removed from the individual wire cages to the nursery, the artificially reared pigs were similar in weight to the sow reared pigs (5kg). Subsequent performance to market weight was similar for both types of rearing.

SUMMARY

Four experiments involving 140 pigs were conducted to evaluate supplementing cow colostrum for artificially reared baby pigs. Colostrum supplementation reduced the incidence of diarrhea and improved average daily gain in the first week of life in 3 of 4 experiments. In the second week, the non-supplemented pigs performance improved and by the third week was equal to colostrum supplemented pigs. At 6 weeks the average weights were similar for all treatments. The livability for colostrum supplemented pigs was 98% versus the 84% for non-supplemented pigs. Under more adverse conditions, this difference may be much greater. Diarrhea does not seem to have a lasting effect on performance, but it does seem to make the pig more susceptible to secondary infections. In these experiments it can be simply stated that diarrhea had either no lasting effect or led to the death of the pig.

In conclusion, this study shows the feasibility of rearing baby pigs on a twice a day feeding schedule. Cow colostrum can be used as an aid to reduce the incidence of infectious diarrhea and to decrease mortality.

LITERATURE CITED

Barber, R. S., R. Braude and K. G. Mitchell. 1955. Studies on milk production of large white pigs. J. Agri. Sci. 46:97.

Bengtsson, G. T. 1974. Identification and characterization of soluble blood serum proteins in newborn piglets. J. Anim. Sci. 38:95.

Braude, R., K. G. Mitchell, M. J. Newport and J. W. Porter. 1970. Artificial rearing of pigs. 1. Effect of frequency and level of feeding on performance and digestion of milk proteins. Brit. J. Nutr. 24:501.

Coalson, J. A. and J. G. Lecce. 1973a. Influence of nursing intervals on changes in serum proteins (immunoglobulins) in neonatal pigs. J. Anim. Sci. 36:81.

Coalson, J. A. and J. G. Lecce. 1973b. Herd differences in the expression of fatal diarrhea in artificially reared piglets weaned after 12 hours vs. 36 hours of nursing. J. Anim. Sci. 36:1114.

Coalson, J. A., J. G. Lecce and E. E. Jones. 1973. Feeding regimens for evaluation of diets for young pigs. J. Anim. Sci. 37:276 (Abstr.).

Danielson, D. M. 1971. Dry matter:water ratios for baby pigs. J. Anim. Sci. 33:229 (Abstr.).

Danielson, D. M. 1972. Group feeding weaned day-old pigs. J. Anim. Sci. 35:1089 (Abstr.).

England, D. C. and J. L. Keeler. 1965. Weight-constant gains by pigs of different birth weights. J. Anim. Sci. 24:847.

English, P. R. and W. J. Smith. 1975. Some causes of death in neonatal piglets. Vet. Ann. 15:95.

Fahmy, M. and C. Bernard. 1971. Causes of mortality in Yorkshire pigs from birth to 20 weeks of age. Can. J. Anim. Sci. 51:351.

Halliday, R. and M. R. Williams. 1976. Passive immunity in the lamb. Effects of a second feed of colostrum on antibody absorption from the first feed. Res. Vet. Sci. 21:173-175.

Harmon, B. G., A. H. Jensen and D. H. Baker. 1973. Influence of dietary antibiotics on antibody response to specific antigens. J. Anim. Sci. 37:1155.

Hartman, P. A., T. M. Ludwick and R. F. Wilson. 1962. Certain aspects of lactation performance in sows. J. Anim. Sci. 21:883.

Haye, S. N. and E. T. Koinegay. 1979. Immunoglobulin G, A and M and antibody response in sow-reared and artificially-reared pigs. J. Anim. Sci. 48:1116.

Hendrix, W. F., K. W. Kelley, C. T. Gaskins and D. J. Hinrichs. Porcine neonatal survival and serum gamma globulins.

Hoerlein, A. B. 1957. The influence of colostrum on antibody response in baby pigs. J. Immunol. 78:112.

Kerncamp, H. C. H. 1965. Birth and death statistics on pigs of preweaning age. J.A.V.M.A. 146:337.

Kohler, E. M. 1967. Studies of Escherichia coli in gnotobiotic pigs. 5. Evaluation of the effects of oral and parenteral administration of immune serum. Can. J. Comp. Med. Vet. Sci. 31:283.

Lecce, J. G. 1969. Rearing colostrum-free pigs in an automatic feeding device. J. Anim. Sci. 28:27.

Lecce, J. G. 1973. Effect of dietary regimen on cessation of uptake of macro-molecules by piglet intestinal epithelium (closure) and transport to the blood. J. Nutr. 103:751.

Lecce, J. G. 1975. Rearing piglets artificially in a farm environment: A promise unfulfilled. J. Anim. Sci. 41:659.

Lecce, J. G., W. D. Armstrong, P. L. Crawford and G. A. Cucharme. 1979. Nutrition and management of early weaned piglets: Liquid vs. dry feeding. J. Anim. Sci. 48:1007.

Lecce, J. G. and J. A. Coalson. 1976. Diets for rearing colostrum-free piglets with an automatic feeding device. J. Anim. Sci. 42:622.

Lecce, J. G., J. A. Coalson and R. Mock. 1972. Viral diarrhea in artificially reared piglets. J. Anim. Sci. 35:219.

Lecce, J. G. and M. W. King. 1978. Diets for rearing extra pigs. Abstr. Am. Soc. Anim. Sci. 70th Ann. Mtg., p. 264.

Lecce, J. G. and G. Matrone. 1960. Porcine neonatal nutrition: The effect of diet on blood serum proteins and performance of the baby pig. J. Nutr. 70:13.

Lecce, J. G. and G. Matrone. 1961. Porcine neonatal nutrition: Effect of weaning time on the maturation of the serum protein profile. J. Nutr. 73:167.

Lecce, J. G., D. O. Morgan and G. Matrone. 1962. Immunoelectrophoretic serum protein changes from birth to maturity in piglets fed different diets. J. Nutr. 77:349.

Lucas, I. A. M., A. F. Calder and H. Smith. 1959. The early weaning of pigs. 4. Comparisons of levels of antibiotic and sources of protein in diets for pigs weaned at 9 lb. live weight. J. Agri. Sci. 53:125.

Martinsson, Kjell. 1970. Immunoglobulin therapy in piglets: A methodogical and experimental study. Acta Vet. Scan. Suppl. 29.

McCallum, I. M., J. I. Elliot and B. D. Owen. 1976. Survival of colostrum-deprived neonatal piglets fed gamma-globulins. Can. J. Anim. Sci. 57:151-158.

Murata, H. and S. Namioka. 1977. The duration of colostral immunoglobulin uptake by the epithelium of the small intestine of neonatal piglets. J. Comp. Pathol. 87(3):431-439.

Owen, B. D. and J. M. Bell. 1964. Further studies of survival and serum protein composition in colostrum-deprived pigs reared in a non-isolated environment. Can. J. Anim. Sci. 44:1.

Owen, B. D., J. M. Bell, C. M. Williams and R. G. Oakes. 1961. Effects of porcine immune globulin administration on the survival and serum protein composition of colostrum-deprived pigs reared in a non-isolated environment. Can. J. Anim. Sci. 41:236.

Oyeniyi, O. O. and A. G. Hunter. 1978. Colostral constituents including immunoglobulins in the first three milkings postpartum. J. Dairy Sci. 61:44-48.

Patt, J. A., Jr. and R. J. Eberhart. 1976. Effects of metyrapone and ACTH on intestinal absorption of immuno-reactive bovine IgG in Cesarean-derived pigs. Am. J. Vet. Res. 37:1409.

Pettigrew, J. E. and B. G. Harmon. 1975. Protein sources for artificially-reared piglets. J. Anim. Sci. 39:188 (Abstr.).

Pierce, A. E. and M. W. Smith. 1967a. The intestinal absorption of pig and bovine immune lacto globulin and human serum albumin by the new-born pig. The in vitro transfer of bovine immune lactoglobulin across the intestine of new-born pigs. J. Physiol. (London) 190:1.

Pierce, A. E. and M. W. Smith. 1967b. The in vitro transfer of bovine immune lactoglobulin across the intestine of newborn pigs. J. Physiol. (London) 190:19.

Pomeroy, R. W. 1960a. Infertility and neonatal mortality in the sow. I. Lifetime performance and reasons for disposal of sows. J. Agri. Sci. 54:1.

Pomeroy, R. W. 1960b. Infertility and neonatal mortality in the sow. III. Neonatal mortality and fetal development. J. Agri. Sci. 54:31.

Pomeroy, R. W. 1960c. Infertility and neonatal mortality in the sow. IV. Further observations and conclusions. J. Agri. Sci. 54:57.

Rejnek, J., J. Travnicek, J. Kostka, J. Sterzl and A. Lane. 1968. Study of the effect of antibodies in the intestinal tract of germ-free baby pigs. Folia Microbiol. 13:36.

Rodeffer, H. E., A. D. Leman and A. G. Mueller. 1975. Development of a record system for measuring swine breeding herd efficiency. J. Anim. Sci. 40:13.

Scoot, A., B. D. Owen and J. L. Agar. 1972. Influence of orally administered porcine immunoglobulins on survival and performance of newborn colostrum-deprived. J. Anim. Sci. 35:1201.

Sharpe, H. B. A. 1966. Pre-weaning mortality in a herd of Large White pigs. Brit. Vet. J. 122:99-111.

Sterzl, J., J. Rejnek and J. Travnicek. 1966. Impermeability of pig placenta for antibodies. Folia Microbiol. 11:7.

Tlaskalova, H., J. Rejnek, J. Travnicek and A. Lane. 1970. The effect of antibodies present in the intestinal tract of germ-free piglets on the infection caused by the intravenous administration of the pathogenic strain Escherichia coli 055. Folia Microbiol. 15:372.

Wilson, M. R. 1974. Neonatal immunologic development. J. Anim. Sci. 38:1018.

EFFECT OF COW COLOSTRUM ON ARTIFICIALLY REARED PIGLETS

by

MARK THOMAS NOLL

B.S., Kansas State University, 1978

AN ABSTRACT OF A MASTER'S THESIS

submitted in partial fulfillment of the

requirements for the degree

MASTER OF SCIENCE

Department of Animal Sciences and Industry

KANSAS STATE UNIVERSITY

Manhattan, Kansas

1979

ABSTRACT

Four experiments involving 140 pigs were conducted to evaluate supplementing cow colostrum for artificially reared baby pigs. Colostrum supplementation reduced the incidence of diarrhea and improved average daily gain in the first week of life in 3 or 4 experiments. In the second week the non-supplemented pigs performance improved and by the third week was equal to colostrum supplemented pigs. At 6 weeks the average weights were similar for all treatments. The livability for colostrum supplemented pigs was 98% versus the 84% for non-supplemented pigs. Under more adverse conditions, this difference may be much greater. Diarrhea does not seem to have a lasting effect on performance but it does seem to make the pig more susceptible to secondary infections. In these experiments it can be simply stated that diarrhea had either no lasting effect, or led to the death of the pig.

In conclusion, this study shows the feasibility of rearing baby pigs on a twice a day feeding schedule. Cow colostrum can be used as an aid to reduce the incidence of infectious diarrhea and to decrease mortality.